

1. A swage type fastener which adequately secures a plurality of workpieces together in a fastened joint in a plurality of applications having different load requirements, the fastener comprising:

(a) a pin selected from a plurality of pin members of different diameters having an elongated shank which is located in aligned openings in the workpieces and terminating at one end in an enlarged head and at its opposite end in a grooved portion comprising a plurality of circumferentially extending lock grooves and crests;

(b) a tubular collar selected from a plurality of collars of different materials, the collar being swaged into the lock grooves whereby the workpieces are adequately secured together in the plurality of applications having different load requirements, the collar having collar grooves and shoulders interlocking the lock grooves and crests, the pin and the collar being of different materials having shear strengths of different magnitudes with the ratio of such shear strengths of the pin to the collar being such that crushing of the pin in swage is substantially avoided in the plurality of applications having different load requirements;

(c) the pin having a uniform lock groove and crest geometry, wherein the lock grooves are provided with the longest width required for collars of lower strength for a shear application or greater strength for a tension application and the crests are provided with the longest width required for collars of greater strength for the tension application whereby

the fastener provides satisfactory clamp and tensile loads and resistance to failure to secure the fastened joint together in the plurality of applications having different load requirements, wherein the applications are selected from the group consisting of shear, shear/tension, tension, shear composite, shear/tension composite and tension composite applications;

(d) the uniform lock groove and crest geometry for the pin is used in the plurality of applications with one or more pins of the selected pin diameter to adequately secure the plurality of workpieces together in the plurality of applications having different load requirements; and

(e) the difference in width of the lock grooves in the tension application is not greater than ten percent of the width of the lock grooves in the shear application.

2. The fastener of claim 1 wherein the collar of lower strength has a shear strength of about 64% of the shear strength of the collar of greater strength.

3. The fastener of claim 1 wherein the collar of lower strength is made of an aluminum alloy and the collar of higher strength is made of a titanium alloy.

4. The fastener of claim 1 wherein the plurality of collars are made of titanium alloys, aluminum alloys or steel alloys.

5. The fastener of claim 1 wherein the lock grooves are overpacked in the range of 17% to 25%.

6. The fastener of claim 1 wherein the workpieces are made of metal, composites or combinations thereof.

7. The fastener of claim 1 wherein the plurality of applications are shear, shear/tension, shear composite or shear/tension composite applications and the plurality of collars of different materials used in such applications have about the same outside diameter and are configured to be swaged into the lock grooves of the pin with an installation tool having a swage anvil with a uniform swage cavity.

8. The fastener of claim 1 wherein the fastener fastens workpieces that vary in thickness up to 1/8 of an inch.

9. A swage type fastener which adequately secures a plurality of workpieces together in a fastened joint in three or more applications having different load requirements, the fastener comprising:

(a) a pin selected from a plurality of pin members of different diameters having an elongated shank which is located in aligned openings in the workpieces and terminating at one end in an enlarged head and at its opposite end in a grooved portion comprising a plurality of circumferentially extending lock grooves and crests;

(b) a tubular collar selected from a plurality of collars of different materials, the collar being swaged into the lock grooves whereby the workpieces are adequately secured together in the three or more applications having different load requirements, the collar having collar grooves and shoulders interlocking the lock grooves and crests, the pin and the collar being of different materials having shear strengths of different magnitudes with the ratio of such shear strengths of the pin to the collar being such that crushing of the pin in swage is substantially avoided in the three or more applications having different load requirements;

(c) the pin having a uniform lock groove and crest geometry, wherein the lock grooves are provided with the longest width required for collars of lower strength for a shear application or greater strength for a tension application and the crests are provided with the longest width required for collars of greater strength for the tension application whereby

the fastener provides satisfactory clamp and tensile loads and resistance to failure to secure the fastened joint together in the three or more applications having different load requirements, wherein the applications are selected from the group consisting of shear, shear/tension, tension, shear composite, shear/tension composite and tension composite applications; and

(d) the uniform lock groove and crest geometry for the pin is used in the three or more applications with one or more pins of the selected pin diameter to adequately secure the plurality of workpieces together in the three or more applications having different load requirements.

10. The fastener of claim 9 wherein the collar of lower strength has a shear strength of about 64% of the shear strength of the collar of greater strength.

11. The fastener of claim 9 wherein the collar of lower strength is made of an aluminum alloy and the collar of higher strength is made of a titanium alloy.

12. The fastener of claim 9 wherein the plurality of collars are made of titanium alloys, aluminum alloys or steel alloys.

13. The fastener of claim 9 wherein the lock grooves are overpacked in the range of 17% to 25%.

14. The fastener of claim 9 wherein the workpieces are made of metal, composites or combinations thereof.

15. The fastener of claim 9 wherein the three or more applications are shear, shear/tension, shear composite or shear/tension composite applications and the plurality of collars of different materials used in such applications have about the same outside diameter and are configured to be swaged into the lock grooves of the pin with an installation tool having a swage anvil with a uniform swage cavity.

16. The fastener of claim 9 wherein the fastener fastens workpieces that vary in thickness up to 1/8 of an inch.

17. The fastener of claim 9 wherein the difference in width of the lock grooves in the tension application is not greater than ten percent of the width of the lock grooves in the shear application.

18. A swage type fastener which adequately secures a plurality of workpieces together in a fastened joint in a plurality of applications having different load requirements, the fastener comprising:

(a) a pin selected from a plurality of pin members of different diameters having an elongated shank which is located in aligned openings in the workpieces and terminating at one end in an enlarged head and at its opposite end in a grooved portion comprising a plurality of circumferentially extending lock grooves and crests;

(b) a tubular collar selected from a plurality of collars of different materials, the collar being swaged into the lock grooves whereby the workpieces are adequately secured together in the plurality of applications having different load requirements, the collar having collar grooves and shoulders interlocking the lock grooves and crests, the pin and the collar being of different materials having shear strengths of different magnitudes with the ratio of such shear strengths of the pin to the collar being such that crushing of the pin in swage is substantially avoided in the plurality of applications having different load requirements;

(c) the pin having a uniform lock groove and crest geometry, wherein the lock grooves are provided with the longest width required for collars of lower strength for a shear application and the crests are provided with the longest width required for collars of greater strength for a tension application whereby the fastener provides satisfactory clamp and tensile

loads and resistance to failure to secure the fastened joint together in the plurality of applications having different load requirements, wherein the applications are selected from the group consisting of shear, shear/tension, tension, shear composite, shear/tension composite and tension composite applications; and

(d) the uniform lock groove and crest geometry for the pin is used in the plurality of applications with one or more pins of the selected pin diameter to adequately secure the plurality of workpieces together in the plurality of applications having different load requirements.

19. The fastener of claim 18 wherein the collar of lower strength has a shear strength of about 64% of the shear strength of the collar of greater strength.

20. The fastener of claim 18 wherein the collar of lower strength is made of an aluminum alloy and the collar of higher strength is made of a titanium alloy.

21. The fastener of claim 18 wherein the plurality of collars are made of titanium alloys, aluminum alloys or steel alloys.

22. The fastener of claim 18 wherein the lock grooves are overpacked in the range of 17% to 25%.



23. The fastener of claim 18 wherein the workpieces are made of metal, composites or combinations thereof.

24. The fastener of claim 18 wherein the plurality of applications are shear, shear/tension, shear composite or shear/tension composite applications and the plurality of collars of different materials used in such applications have about the same outside diameter and are configured to be swaged into the lock grooves of the pin with an installation tool having a swage anvil with a uniform swage cavity.

25. The fastener of claim 18 wherein the fastener fastens workpieces that vary in thickness up to 1/8 of an inch.